

Chapman Conference on Vertical Crustal Motion: Measurement and Modeling

A Chapman Conference on Vertical Crustal Motion: Measurement and Modeling will be held October 22–26, 1984, in Harpers Ferry, West Virginia.

Convenor: William E. Strange

This conference will bring together scientists who measure vertical crustal motions and those who analyze and model these motions with the primary objective of obtaining close interaction between the two groups. Emphasis will be on vertical crustal movement in North America. Questions to be addressed will be (1) what are the accuracies and error sources associated with each data type? (2) What is the extent of the current data base? (3) How accurately do we know vertical crustal motions in North America? (4) What are realistic expectations of contributions from space systems and other new technologies in the next decade? (5) What is the current status of modeling vertical crustal motions? (6) How important is vertical motion information to understanding and modeling earth dynamics? (7) What are the measurement requirements to support modeling and analysis in terms of temporal and spatial density and accuracy? (8) What are the most critical deficiencies of vertical motion data relative to modeling and analysis?

There will be invited and contributed presentations. The Call for Papers was published in the March 20, 1984, issue of *Eos*. Abstract deadline is August 1, 1984. Abstracts should be submitted to the American Geophysical Union.

For information on the required abstract format or further meeting logistics, contact:

AGU Meeting Department
2000 Florida Avenue, N.W.
Washington, D.C. 20009
(202) 462-6903

For program information contact:
Dr. W. E. Strange
NOAA/NOS/CNGS/NCS/N/CG11
6001 Executive Blvd.
Rockville, MD 20852
(301) 443-2520

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displays retransmission of data messages automatically.

The Actual Experiment

The RST installation in the U.N. restaurant was uneventful and took only 30 min. The actual experiments in three steps were preceded by a brief talk on whys and hows. Also, the video screen proved very useful for large audience display of terminal operations.

Step 1. RST to RSTE communication. Automatic dialing and log in on a PDP11/44 running UNIX in Washington, D.C., over the ordinary telephone network using Bell 212 modems. Transfer of waveform data (level II data) and bulletins (level I data) from Washington to Geneva. In Geneva, we immediately

displayed the analog waveforms on the raster scan graphic display screen and the video screen.

Step 2. RST to RSTE communication. This involved dialing and log in on a PDP11/44 at NORSAR, Kjeller, Norway. From the PDP11/44, we extracted real-time information on the status of the seismic network in southern Norway, including the detection log, which in turn was used to select a few, presumed particular events for display and analysis on the mentioned screens. Also, waveform data from the NORSAR library were extracted and displayed.

Step 3. This involved calling the Northstar "sister" RSTE in Trondheim. After establishing the modem link, we were able to demonstrate the RSTE functions described in the

Acknowledgments

We are much indebted to the Royal Norwegian Ministry of Foreign Affairs for research

News

Venus Mapper Resolution

NASA program managers for the Venus Radar Mapper (VRM) mission have decided to make improvements to the spacecraft's Synthetic Aperture Radar (SAR) system that will increase its mapping resolution by one and a half times over the original design. The changes, including a doubling of the system's range bandwidth, will add a total of about \$5 million to a project budgeted at \$350 million. VRM is scheduled for launch toward Venus in April 1988 and will map more than 90% of the cloud-veiled planet's surface during its 8-month mission.

The decision by the VRM program office at NASA headquarters in Washington was based on recommendations from the mission's project office at the Jet Propulsion Laboratory in Pasadena, Calif. When VRM was included as a new start in this year's NASA budget, the stated goals for the mission were to provide a near-global map of Venus at resolutions better than 1 km, or roughly equivalent to the resolution of the Mariner 9 mission that first revealed the geological richness of the Martian surface. The actual best radar resolution was to have been about 180 m (equivalent to an optical line-pair resolution of 300 m) attainable for more than half the surface of the planet. VRM will travel an elliptical orbit and so will only be able to map the surface for a fraction of each day. The highest resolution will come in the equatorial regions when the spacecraft is closest to the planet and the radar "look angles" are the greatest.

Now, with the improvements to the SAR system, the resolution will range from 120 m (again for more than half the surface) to about 190 m in the higher Venus latitudes. This is nearly an order of magnitude better than what the Soviets have obtained with their *Venera* 15 and 16 orbiters now ending their mapping missions around Venus. These spacecraft are mapping between 25 and 39% of the planet, primarily around the north polar region, at resolutions ranging between 1 and 2 km. While the *Venera* images have

Anne Burford to NACOA

Anne Burford, who resigned as administrator of the U.S. Environmental Protection Agency (EPA) in March 1983, has been appointed chairman of the National Advisory Committee on Oceans and Atmosphere (NACOA). Seven others have been appointed to the 18-member committee, which advises the president on ocean and atmosphere policy.

Burford succeeds John A. Knauss as NACOA chairman. Knauss, whose term of office on NACOA officially expired on July 1, had been on the committee for 6 years. Burford resigned from EPA following controversy over hazardous wastes.

In his proposed budget for fiscal 1985, as in recent years, President Ronald Reagan eliminated NACOA. In previous years, Congress has reinstated the committee. Bills (S. 1098 and S. 2538) to reinstate NACOA for fiscal 1985, which begins October 1, have been introduced and have been hotly debated in Congress. A conference between members of the House of Representatives and the Senate to discuss NACOA's future—including reconstituting the committee in a different form—will be held probably between July 28 and August 10.

Also appointed to NACOA are John E. Bennett, a retired Navy captain from Solana Beach, Calif. His term expires in 2 years. William Brewster, vice president and director of the Atlantic Salmon Foundation and chairman of the executive committee of the International Atlantic Salmon Foundation, will serve until July 1985. Lee Gerhard, Getty Professor of Geology at the Colorado School of Mines, has been appointed until July 1986. Judith Kildow, appointed through July 1986, is an associate professor of ocean policy at the Massachusetts Institute of Technology. Mary Ellen McCaffree, appointed through July 1988, is former administrative assistant to Sen. Slade Gorton of Washington and former director of the department of budget and program development for King County, Wash. Nathan Sonnenstein, whose term ex-

pires in 1986, is assistant to the president of Global Marine Development, Inc., of Newport Beach, Calif. Gordon Snow, appointed through 1985, is assistant secretary for resources of the California Resources Agency in Sacramento, Calif.

The next NACOA meeting is August 2 in Washington, D.C. NACOA meets eight times per year. Steven N. Anastas is the executive director.—BTR

grants which made this work possible. Special thanks go to Ambassador Sten Lundin, Norwegian Mission, Geneva, for support and encouragement and to A. U. Kerr (DARPA) for invaluable conceptual advice. NORSAR contribution 335.

References

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The next step is to improve both RSTE and RST, particularly adding a more powerful CPU, an array processor for FFT matrix inversion, etc., and a few megabytes of memory to the RSTE. This will permit extensive data operations in the field and also allow distributed processing in the nodes of our network.

Future Prospects

The next step is to improve both RSTE and RST, particularly adding a more powerful CPU, an array processor for FFT matrix inversion, etc., and a few megabytes of memory to the RSTE. This will permit extensive data operations in the field and also allow distributed processing in the nodes of our network.

Additional field functions might include more filtering options, beam forming, spectral analysis, and rough event locations. The RSTE would then be able to generate automatic bulletins (level I data) and higher quality level II data. The net result will be less communication and thus more cost effective operations.

The RST development will be directed toward the expert-system concept. This means that an RST should administer several RSTE's and retrieve event data relevant for traditional analysis work and research. It should also have the option to retrieve bulletins, information that would be very helpful in local bulletin work. With such a data base hinted at above, combined with advanced analysis routines, interactive analysis and wave parameter extraction should function expertly. Most important, individual seismologists, particularly those with a knack for microprocessor technology, should be able to participate actively in these developments, even from their studies at home.

Acknowledgments

We are much indebted to the Royal Norwegian Ministry of Foreign Affairs for research

proven very interesting to the few American scientists who have had access to them (the Soviets still have not released the pictures publicly), VRM promises much sharper images and more complete coverage.

It was the Venus results, in fact, that provided the impetus to make the improvements to VRM's radar system. "When our (VRM team) scientists looked at the Soviet images and began seeing all the interesting topography, they began to see how much more detail they wanted," says VRM Program Manager Rodney Mills. "We decided we wanted to squeeze out as much resolution as possible." Gordon Pettengill of the Massachusetts Institute of Technology, the radar instrument's Principal Investigator, says that at resolutions close to 100 m, scientists should be able to detect all the processes that might shape the Venusian surface with the exception of wind erosion. The clarity of the VRM images will be particularly helpful in dating the relative ages of overlapping lava flows on the surface.

According to Mills, the improvements to the radar system will affect range resolution, but won't significantly affect the azimuth resolution of the images. The SAR instrument, built by Hughes Aircraft, is the only science instrument on the VRM spacecraft. The radar is similar to the ones that have been flown successfully on the Seasat mission and the Shuttle Imaging Radar-A (SIR-A) experiment that flew onboard *Columbia* during the second flight of the space shuttle. It operates on the principle that changes in Doppler shift of a reflected signal can be combined with range data to construct two-dimensional images of a planet's surface that resemble photographs.

Because Venus is perpetually enshrouded by clouds, radar is the only means to image its surface.

VRM's Radar Mapper will also soon have a new name. NASA officials have been whittling away at a list of candidate names that include some historical figures (along the line of Galileo and Giotto) and some more traditional spacecraft names (along the line of Voyager and Pioneer). VRM is expected to shed its acronym and be "rechristened" sometime before the end of July. —TS

Water in Cirrus Clouds

Meteorologists from the University of Utah have discovered water droplets as cold as -36°C at the base of cirrus clouds, the coldest temperatures at which liquid water has been confirmed in clouds. Because earlier models of radiation transfer in the atmosphere had assumed that the clouds at cirrus layer altitudes (6,000–12,000 m) were composed only of ice crystals, the presence of liquid water may affect how these models are constructed.

A team led by Kenneth Sassen of Utah's Department of Meteorology used ground-based polarization laser radar (lidar) to detect the water droplets in a cirrus cloud layer approximately 8.2 km above Boulder, Colo., last October. By analyzing the polarization of laser light reflected from cloud particles, the lidar system can identify whether the cloud contains water or ice crystals and can provide information on the type and distribution of ice crystals within the cloud.

The lidar results were supported by data from an instrumented aircraft of the National Center for Atmospheric Research (NCAR) in Boulder, which flew through the 1.9-km-thick cirrus cloud near its base, measuring the sizes and concentrations of crystals and droplets. The combined lidar and aircraft data showed that liquid water droplets occurred in a narrow layer at the bottom of the cloud, with a density of up to 130 drops per cubic centimeter and temperatures as low as -35° to -36°C. Within 100 yards above the base of the cloud, the water appeared to freeze rapidly into ice crystals.

The supercooled liquid droplets, according to Sassen, probably are short-lived, lasting "only a matter of minutes" before freezing. At temperatures below -40°C, he said, water is believed to freeze spontaneously. These droplets, however, take some time before they turn to ice. A possible explanation is that there is a relative scarcity of dust particles and other condensation nuclei at the high cirrus altitudes, so that it takes longer for the ice crystals to form than it does at lower altitudes.

Cirrus clouds have been shown to play a part in the transfer of solar and terrestrial radiation through the atmosphere, and this radiation budget in turn has a great effect on global climate and the atmospheric greenhouse effect. Climate modelers have assumed up until now that cirrus clouds were made entirely of ice crystals and have used approximations of the hexagonal shape of these crystals in their computer models to predict how radiation will be scattered. Water droplets are spherical, though, and they scatter radiation differently than hexagonal crystals. If the water layer is a permanent feature at the base of cirrus clouds, even if the layer is only 100 m thick, it would mean a change in the radiation transfer models. The next step, according to Sassen, is to continue lidar investigations of other cirrus clouds to see if this water layer occurs elsewhere and if the base of the clouds remains watery over a long period of time.

BOSP is seeking information on the needs and opportunities in the field as broadly defined as ranging from augmentation of existing activities to new facilities to new ideas. In its first stage, the study will consist of a series of reports focused on 10 areas (see list below). The second stage will focus on themes that link the defined disciplines. Ideas and suggestions about linking themes also are welcome for the BOSP report.

The areas of study and the scientists assembling information on them are listed below.

- Oceans 2000: Brian J. Rothschild (University of Maryland, Solomons) and John H. Steele (Woods Hole Oceanographic Institution)
- Physics: D. James Baker, Jr. (Joint Oceanographic Institutions, Inc.)
- Geology and geophysics: Charles L. Drake (Dartmouth College)
- Water disposal: Edward Goldberg (Scripps Institution of Oceanography)
- Minerals: G. Ross Heath (Oregon State University)
- Policy science and law: Judith T. Kildow (Massachusetts Institute of Technology)
- Biology: James J. McCarthy (Harvard University)
- Weather and climate: Roger Revelle (University of California, San Diego)
- Chemistry: Karl K. Turekian (Yale University)
- Economics and business: Robert M. Solow (MIT).

In addition, the House passed H.J. Res. 558, which designates July 20, 1984, as Space Exploration Day, in commemoration of the 15th anniversary of the Apollo 11 moon landing. The House also passed S.J. Res. 257, which designates the year that began July 1, 1984, as the Year of the Ocean (Eos, June 19, 1984, p. 402). The Senate had passed the measure on June 8.

The House approved a version of H.R. 3292 reauthorizing and amending the Clean Water Act. Although the Senate Environment and Public Works Committee reported out the Senate version of the bill 9 months ago, the entire Senate has not voted on the bill.

The House passed the Water Resources Authorization (H.R. 3078) by a 230 to 33 margin on June 29. There is no companion bill in the Senate. The bill details steps for the "conservation and development of water and related resources and the improvement and rehabilitation of the nation's water resources infrastructure." Much of the bill deals with regulating beach erosion, floods, drinking water supplies, and channel navigation, construction, and engineering in the U.S. Army Corps of Engineers.—BTR

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Meetings (cont. from p. 445)

Aug. 21, St. Louis 300, Springfield, IL 62706; tel: 217-785-2001.

Sept. 13-14 Symposium on New and Innovative Geotechnical Solutions for Water Needs, St. Louis, Mo. Sponsor: Louisiana World Exposition International Water Symposium Series, Louisiana World Exposition Inc., P.O. Box 19841, New Orleans, LA 70159-19841 (July 3, 1984).

Sept. 19-21 Short Course on Computational Methods in Urban Hydrology and Sediment Transport, University of Colorado, Boulder, CO 80309. Sponsor: University of Colorado, Boulder, Program Coordinator, 219 Sackett Building, University Park, PA 16802; tel: 814-863-0161.

Sept. 20-21 International Symposium on Environmental Pollution, Site To Be Announced, (Vancouver, B.C., Canada) (July 17, 1984).

Sept. 21-25 Petroleum and Natural Gas Markets Conference, Calgary, Alberta. Sponsor: Canadian Energy Research Institute, Calgary Chamber of Commerce, Ian Strelak, Conference Director, Canadian Energy Research Institute, 3312 33rd St. NW, Calgary, Alberta, T2L 2A9, Canada; tel: 403-242-5753.

Sept. 22-24 Enhanced Biological Removal of Phosphorus From Wastewater, Paris, France. Sponsor: International Assoc. on Water Pollution Research and Control, (Michel Ploquin, Phosphorus Seminar, Avenue Reine Astrid, 52, Rue d'Anjou, 75384 Paris Cedex 08, France); tel: 33-1-46-61-6183.

Sept. 24-26 International Water Well Exposition, Las Vegas, Nev. Sponsor: National Water Well Assoc., (National Water Well Assoc., 500 W. Wilson Bridge Rd., Washington, DC 20001; tel: 202-341-0355).

Sept. 24-26 MEADS (Saline Lakes, Evaporation, Aeolian Deposits) Workshop on Coastal, Salt, Shallowground, and Palaeo-environments, Mathoura, New South Wales, Australia. Sponsor: the Australian National Univ., (J. M. Bowler, Dept. of Biogeography and Geomorphology, Research School of Earth Sciences, Australian National Univ.) (March 27, 1984).

Sept. 24-26 National Groundwater Quality Symposium, Las Vegas, Nev. Sponsor: National Water Well Assoc., (N.W.W.A., 500 W. Wilson Bridge Rd., Washington, DC 20001; tel: 202-341-0355).

Sept. 26-29 Symposium on the Quaternary of Virginia, Charlottesville, Va. Sponsor: Virginia Department of Mineral Resources, (801 N. 12th St., 10th Floor, Richmond, VA 23219; tel: 804-293-5121) (June 26, 1984).

Sept. 26-29 International Symposium on Recent Investigations in the Zone of Aeration, Michigan, MI. Sponsor: Technical Univ. of Munich, (P. Ullrich, RIZA Symposium, Institut für Wasserbau der TU München, Mathenstrasse 17, D-8000 Munich 70, FRG) (Dec. 20, 1983).

Oct. 1-5 International Seismological Commission, Moscow, (Organizing Committee, E.S.C., Soviet Geophysical Committee, Molodzhanova 3, 117 206 Moscow, USSR).

Oct. 2-4 1984 Rocky Mountain Conf. Symposium, Biomass, N. Dak. Sponsor: North Dakota Geological Society, (Robert Houghen, U.S. Geological Survey, Box 2450, St. Paul, MN 55144; tel: 612-733-4011).

Oct. 3-5 1984 Arctic Seience Conference (13th Alaska Science Conference), Anchorage, Alaska. Sponsor: AAAS Arctic Division (John Davier, P.O. Box 80271, Fairbanks, AK 99708; tel: 907-474-7371) (May 1, 1984).

Oct. 3-5 Symposium on the Development and Geomorphology of Northern Glaciated Landscapes, Anchorage, Alaska. Sponsor: American Meteorological Society and AAAS (Mauri Biedler, National Weather Service, 701 C St., P.O. Box 23, Anchorage, AK 99513) (March 6, 1984).

Oct. 8-10 18th Annual Assoc. of Earth Science Editors Conference, Portland, Ore. (Assoc. of Earth Science Editors, 4220 King St., Alexandria, VA 22302).

Oct. 11-12 World Conference on Remote Sensing, Bayreuth, FRG. Sponsor: Univ. of Bayreuth, Texas Christian Univ. Center for International Sensing, and Energy Research, and International Society of Toxicological and Environmental Chemistry (Les Newland, Director, Environmental Sciences Program, Texas Christian Univ., Fort Worth, TX 76129; tel: 817-921-7271) (Feb. 7, 1984).

Oct. 9-12 Annual Meeting of the Division for Planetary Sciences of the American Astronomical Society, Kailua-Kona, Hawaii. Sponsor: The Hawaii Institute of Geophysics and the Institute of Geophysics and Planetary Sciences, Univ. of Hawaii Institute of Geophysics and Planetary Sciences Div., Hawaii Institute of Geophysics, Univ. of Hawaii, 2223 Ureka Road, Honolulu, HI 96822 (April 21, 1984).

Oct. 10-12 Seismological Society of America Eastern Section 36th Annual Meeting, St. Louis, Mo. (Robert B. Herrmann, Dept. of Earth and Atmospheric Sciences, Univ. of Illinois, Box 3932, Urbana, IL 61801; tel: 217-333-1321).

Oct. 10-11 New Mexico Geological Society 5th Annual Field Conference, Taos, N.M. (R. Becker, General Chairman, Univ. of New Mexico, Dept. of Earth and Planetary Sciences, Box 30001, NM 87501; tel: 505-245-2830).

Oct. 10-13 Symposium on World Water Watch, New Orleans. Sponsor: Unisys World Exposition, (International Water Symposium Series, Unisys World Exposition Inc., P.O. Box 19841, New Orleans, LA 70159-19841) (July 3, 1984).

Oct. 13-15 Conference on the Origin of the Moon, Paris, France. Sponsor: Lunar and Planetary Institute, (Int'l. Planetary Sciences of the American Astronomical Society, (Pats Jones, Lunar and Planetary Institute, 3303 NASA Rd. 1, Houston, TX 77058) (June 12, 1984).

Oct. 13-17 First Magellanic-Hawaiian Conference on Geodynamics, Orlando, Fla. Sponsor: Florida Institute of Technology, (Robert S. Ladd, Director, Florida Institute of Technology, Dept. of Geology, University of Central Florida, Orlando, FL 32816; tel: 305-273-2913).

Oct. 13-19 Seminar on Interplanetary Color Graphical for Earth and Planetary Resources Management, San Diego, CA. Sponsor: Currell Univ. (Dan Currell, Program Coordinator, Cornell Univ., Box 423 B12 Ives Hall, Ithaca, NY 14853; tel: 607-250-1987).

Oct. 14-21 IUGG Fall Meeting, San Francisco, California. Sponsor: International Geophysical Correlation Programme, (Alan Nairn, Univ. of South Carolina, Columbia, SC 29208).

Oct. 14-18 Statistics Symposium on National Energy Issues, Seoul, South Korea. (Robert K. Kimball, Director, Korea Institute of Energy and Mineral Resources, P.O. Box 100-199, Seoul, Korea) (July 18, 1984).

Oct. 14-18 Symposium on Water Management, Local Involvement, (M. Ator, N.J. Sponsor: North American Lake Management Society, (Larry Gibbons, Dept. of Civil and Environmental Engineering, Washington State Univ., Sloan Hall 111, Pullman, WA 99164-2912) (March 6, 1984).

Oct. 14-19 IAPG Annual Meeting, Orlando, Fla. (John J. Finnegan, General Chairman, Timmons Associates, P.O. Box 806, Jacksonville, FL 32233; tel: 904-246-1533).

Oct. 17-19 CRRRE/ARO Workshop on the Interaction of Radar with the Seasonal Snow Cover, (Cold Regions Research and Engineering Laboratory, Rader, N.H. Sponsor: CRRRE/ARO Hydrology Section, U.S. Colleget, 72 Lyne Road, Hanover, NH 03755).

Oct. 22-25 Chapman Conference on Vertical Crustal Motion Measurement and Modeling, Tucson, Ariz. Sponsor: (Verne E. Simpson, Dept. of Hydrogeology and Water Resources, Dept. of Engineering, Univ. of Arizona, Tucson, AZ 85724).

Oct. 23-25 Short Course on Engineering and Economic Assessment of Geothermal Resources, San Francisco, CA. Sponsor: Geothermal Resource Council, (Grace Mata, Geothermal Resource Council, P.O. Box 1350, Davis, CA 95617-1350; tel: 408-758-2500).

Oct. 23-25 Undersea Mining Institute, Madison, Wis. (Robert Moore, Program Chairman, Univ. of Texas at Austin, Marine Science Institute, 2001 East 31 St., Austin, TX 78705; tel: 512-471-8161).

Oct. 29-30 Conference on Methods for Evaluation of Groundwater Contamination, East Lansing, Mich. Sponsor: Michigan Dept. of Natural Resources, (Michigan Dept. of Natural Resources, Stevens T. Mason Building, Box 30292, Lansing, MI 48909).

Oct. 30-31 Conference on Geopotential Research, Maslson (GRM) Science, College Park, Md. Sponsor: National Aeronautics and Space Administration, (Walter J. Walker, Code 652, NASA Headquarters, Washington, DC 20585; tel: 301-920-4355).

Oct. 30-31 Symposium on the Quaternary of Virginia, Charlottesville, Va. Sponsor: Virginia Department of Mineral Resources, (801 N. 12th St., 10th Floor, Richmond, VA 23219; tel: 804-293-5121).

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Oct. 5-7 Regional Seismological Commission, Moscow, (Organizing Committee, E.S.C., Soviet Geophysical Committee, Molodzhanova 3, 117 206 Moscow, USSR).

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Oct. 13-15 Symposium on World Water Watch, New Orleans. Sponsor: Unisys World Exposition, (International Water Symposium Series, Unisys World Exposition Inc., P.O. Box 19841, New Orleans, LA 70159-19841) (July 3, 1984).

Oct. 13-15 Conference on the Origin of the Moon, Paris, France. Sponsor: Lunar and Planetary Institute, (Int'l. Planetary Sciences of the American Astronomical Society, (Pats Jones, Lunar and Planetary Institute, 3303 NASA Rd. 1, Houston, TX 77058) (June 12, 1984).

Oct. 13-17 First Magellanic-Hawaiian Conference on Geodynamics, Orlando, Fla. Sponsor: Florida Institute of Technology, (Robert S. Ladd, Director, Florida Institute of Technology, Dept. of Geology, University of Central Florida, Orlando, FL 32816; tel: 305-273-2913).

Oct. 13-19 Seminar on Interplanetary Color Graphical for Earth and Planetary Resources Management, San Diego, CA. Sponsor: Currell Univ. (Dan Currell, Program Coordinator, Cornell Univ., Box 423 B12 Ives Hall, Ithaca, NY 14853; tel: 607-250-1987).

Oct. 14-21 IUGG Fall Meeting, San Francisco, California. Sponsor: International Geophysical Correlation Programme, (Alan Nairn, Univ. of South Carolina, Columbia, SC 29208).

Oct. 14-18 Statistics Symposium on National Energy Issues, Seoul, South Korea. (Robert K. Kimball, Director, Korea Institute of Energy and Mineral Resources, P.O. Box 100-199, Seoul, Korea) (July 18, 1984).

Oct. 14-18 Symposium on Hydrothermal Alteration and Geothermal Brine Chemistry, Processing, and Mineral Recovery, Palm Springs, Calif. Sponsor: (University of Canada, 51 St. John St., Suite 800, Ottawa, Ontario K1A 1H3, Canada) (July 18, 1984).

Oct. 14-18 Symposium on Vertical Motions in the Equatorial Upper Ocean and its Effects on Living Resources and the Atmosphere, Paris, France. Sponsor: Scientific Committee on Oceanic Research (SCOR), (David Halpern, NOAA PMEL, 7600 Sand Point Way NE, Seattle, WA 98103).

Oct. 14-18 IAPG Annual Meeting, Orlando, Fla. (John J. Finnegan, General Chairman, Timmons Associates, P.O. Box 806, Jacksonville, FL 32233; tel: 904-246-1533).

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